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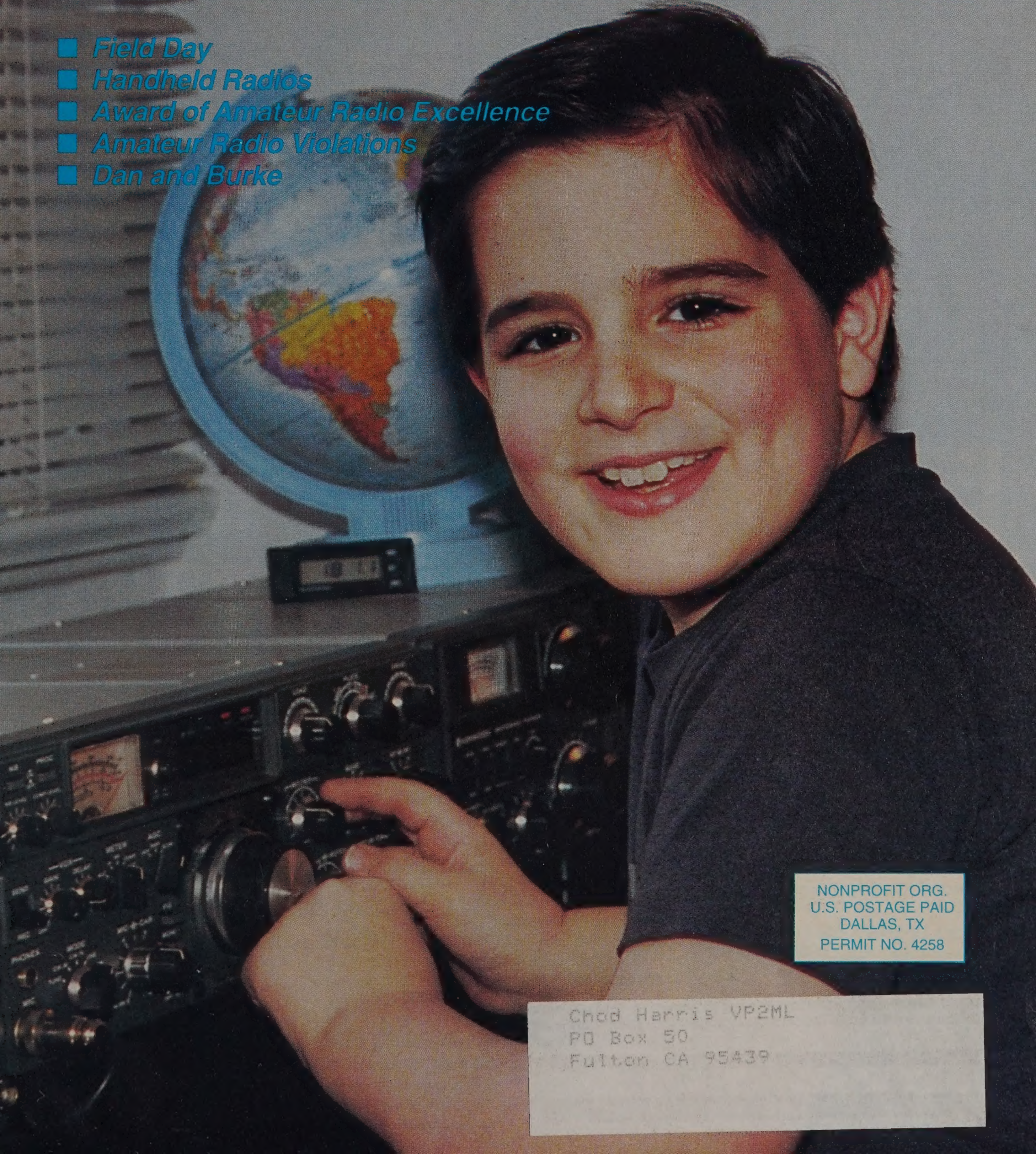
The Amateur Radio
COMMUNICATOR

MAY/JUNE 1993 FOR THE NOVICE AND TECHNICIAN AMATEUR Volume 3 Number 3

- Field Day
- Handheld Radios
- Award of Amateur Radio Excellence
- Amateur Radio Violations
- Dan and Burke



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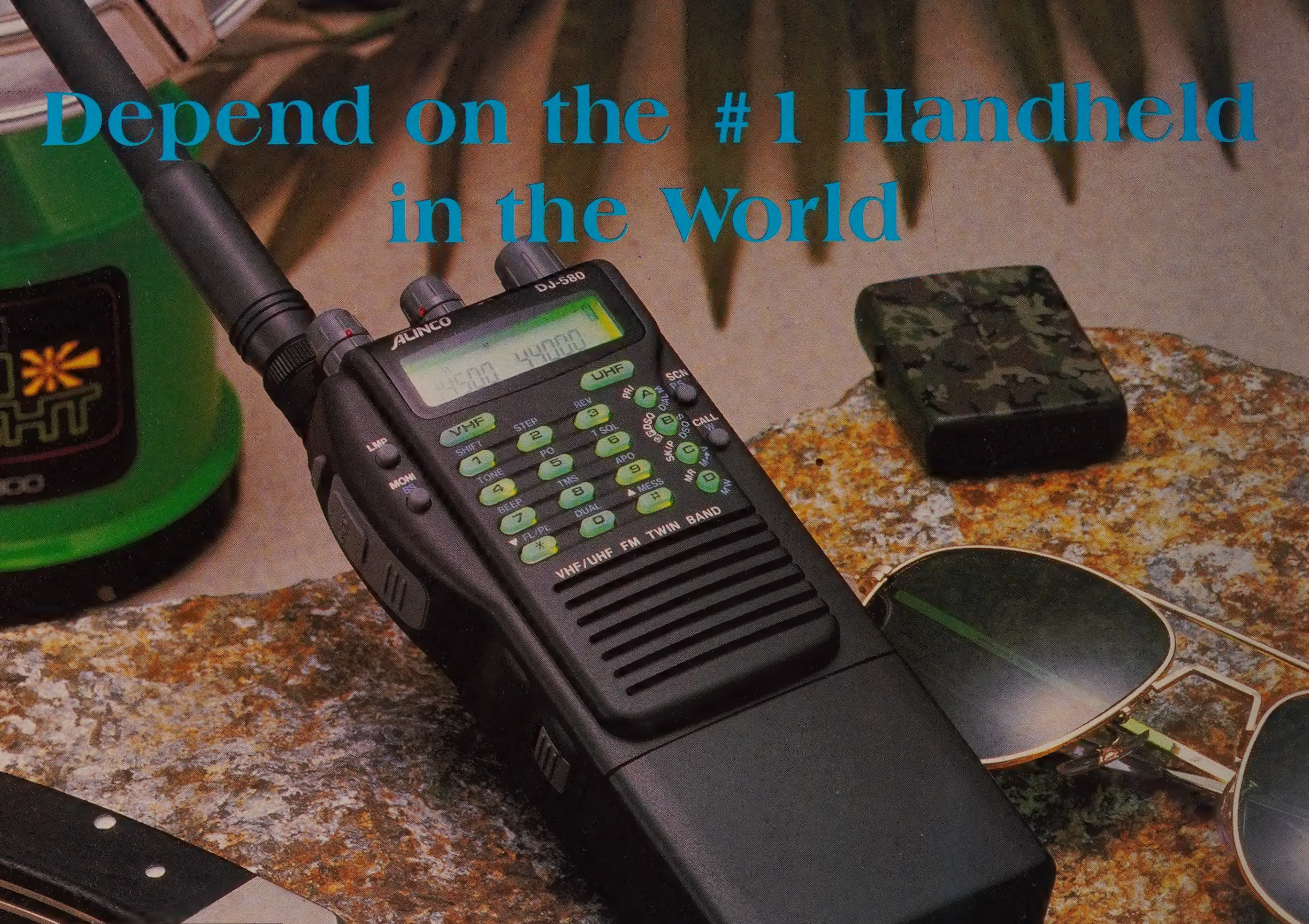

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ON THE COVER

Thomas Donovan, AA2NF, may be the youngest Amateur Extra class ham at nine years old. He is a fourth-grader at Steward School in Garden City, Long Island, New York.

Tom is a member of the ARRL, the National Amateur Radio Association and numerous local clubs. We should add that Tom has given a half-hour talk to his fourth grade class, hosted a Cub Scout Den meeting about ham radio and gotten his whole family involved. After he became licensed, his dad John got interested and became N2SPO, brother John, Jr. is KB2OZO and Mom, Karen, has just passed her Novice and Technician exam. Our fraternity needs more hams like Tom Donovan!

The Amateur Radio Communicator

The Amateur Radio Communicator is published bi-monthly and is the official journal of the National Amateur Radio Association (NARA), P.O. Box 598, Redmond, WA 98073-0598.

The National Amateur Radio Association is incorporated in the State of Washington and is a non-profit organization as defined in Section 501(c)(3) of the Internal Revenue Service Code.

Organization Goals

The broad goal of NARA is to publicize Amateur Radio and to encourage people to become Amateurs by earning an entry level Novice or Technician Class license.

The organization has five specific goals within this broad framework. These are to a) publicize Amateur Radio to the general public, b) attract young people to the Amateur Radio Service, c) increase the stature and benefits of the Novice and Technician Class licenses, d) represent the interests of Novice and Technician Class Amateurs at the national level and e) make all Amateurs aware that our radio frequencies are in jeopardy from commercial interests. More specifically:

A. NARA advertises in various consumer publications to create public awareness of the Amateur Radio Service.

B. NARA is interested in encouraging young people to join our fraternity. A core of young people insures growth of the Amateur Radio Service.

C. NARA believes that the Novice and Technician classes are important and respected entry level licenses into the Amateur Radio fraternity. We are committed to increasing their benefits and stature in the Amateur Radio community.

D. NARA is committed to representing the interests of all Novice and Technician Class Amateurs at the national level. We continue to review information from the Federal Communications Commission and submit material to them with the Novice and Technician perspective in mind.

E. Finally, NARA is very concerned that confiscation of frequencies assigned to the Amateur Radio Service will continue. NARA is committed to obtaining new spectrum for the continued growth in numbers of Novice and Technician Class Amateurs.

Membership and Subscriptions

Those joining NARA receive a subscription to *The Amateur Radio Communicator* for one year. The combined cost of membership and magazine is $10.00 per year in all areas with a U.S. ZIP code.

The NARA membership and subscription to *The Amateur Radio Communicator* cannot be separated.

It is not necessary to hold an Amateur Radio license to become a member of the National Amateur Radio Association. The only "qualification" is an interest in radio communications.

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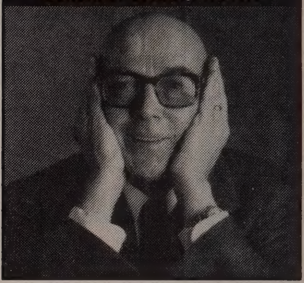

It's Not Our Problem—Or Is It?

by Don Stoner, W6TNS

WHEN SOMEthing like this happens, it makes me realize how lucky we hams are to have our frequency allocations. I'm referring to the recent *FCC Notice of Proposed Rule Making* in P.R. Docket 92-235. The Commission proposes a total restructuring of the 72 MHz band. This is the frequency band where those into the control of model craft by radio hang out.

The FCC wants to tighten up the channel spacing. This will have the effect of inserting two new channels between many of the existing R/C channels. In many cases, **the new channels would be only 2.5 kHz away from a frequency used for radio control!**

As technology moves along, and our spectrum becomes more precious, it is expedient to reduce spacing between channels. This allows more stations to occupy a given amount of spectrum, which is—I suppose—in the best interests of the public.

In this instance, however, it is certainly not in the best interests of those who fly model airplanes. By narrowing the channel spacing, some commercial channels will be so close to radio control frequencies so as to make them useless. The existing spacing between channels is now 10 kHz and the new standards would affect all but 19 of the 50 frequencies allocated for control of models by radio.

It is a relatively simple task to improve the performance of base and mobile equipment. The designer uses multiple-tuned circuits in the "front end" of the receiver along with mega-pole crystal filters to virtually eliminate adjacent channel reception, even 10 kHz away. Try packing all this electronic junk on a tiny circuit board and then cramming it into a model airplane with an 18-inch wingspan. To make a very bad pun, *it ain't gonna fly!*

▼

I would like to invite all modelers to consider earning a no-code Technician license and flying on the six-meter band.

What does all this have to do with ham radio? Besides pointing out how lucky we Amateurs are, **I would like to invite all modelers to consider earning a no-code Technician license** and flying on the six-meter band. Those involved in band planning six meters have allocated a number of channels for this application. In many parts of the country, the band is not extensively used. There is no adjacent channel interference and skip is seldom a problem.

The art of controlling models by radio could come full circle if modelers earn a ham license. The hobby of flying models by radio control actually has its roots in Amateur Radio. In the late '30s and early '40s, the Goode brothers wrote a number of articles in *QST* magazine on the subject. After the Second World War, many people became attracted to the pastime and petitioned the FCC for frequencies where they could locate their transmitting equipment. The FCC agreed this request was in the public interest and allocated five channels in the 27 MHz band. These were wedged between the 23 (and later 40) voice channels.

Skip, of course, became a big problem along with "slopover" from adjacent channels—particularly when some bozo added a "power mic" to jack up their modulation into the supersonic region. It wasn't long before modelers realized these were really "dreg" frequencies for their application.

Once again, the modelers petitioned the FCC and the Commission responded positively. It granted allocations in the 72 MHz band on a secondary basis along with land mobile, zillions of pagers, remote telecommand devices of various types and miscellaneous communications services.

Once again the modelers have made the best of a bad situation. For many years they have used these channels for controlling their aircraft by radio. And now literally millions of dollars worth of radio control equipment will be obsolete, or must be rechannelized. Modelers will no longer be able to fly dozens of planes at the same time and sequential sorties will once again become the norm.

I wish modelers the very best in their protest to the Commission and their legislators. I hope they can find a "homeland" for their activity that is interference-free. However, the Commission will do what it feels is in the best interests of the general public (a case-in-point—our 220 MHz allocation) regardless if it hurts a small segment (read modelers). If this is the case, I hope these people will earn their Amateur license and move to six meters. The Amateur fraternity and The National Amateur Radio Association would welcome them.

73 Don, W6TNS

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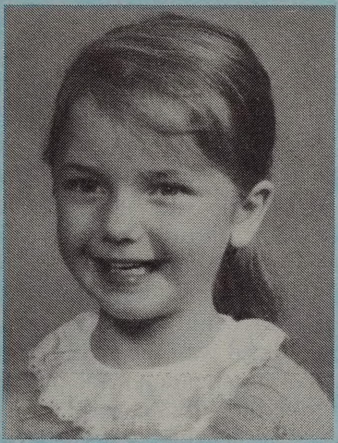
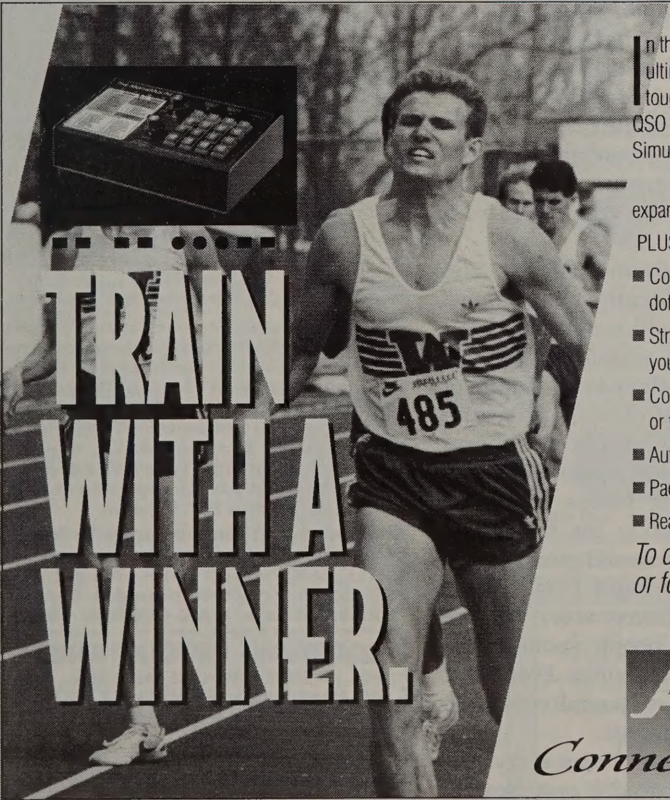
When I hear people say they can't get an Amateur license, I think of Veronica Harrington, KC6TQR. She certainly qualifies as a YL (young lady) at five years old! No one has challenged her claim to be the youngest Amateur Radio operator.



Veronica was born in November 1985, and passed her Novice exam in March 1991 and the Technician test the following May. In addition to her passion for ham radio, she is taking Kumon math and studying Japanese. She can read and write Hiragana and Katakana and is starting beginning level conversation. She also plays table soccer and chess.

With inquiring minds like Veronica, the Amateur Radio Service is bound to prosper and grow.



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Looking Forward By Looking Back

by Mark L. Dubay, KH2FG

MY COPY OF *THE Amateur Radio Communicator* came today. I read it cover to cover. It reminded me of when I first became a ham. Those were terrific days of pondering all the advertisements in *QST*, *CQ*, and *73* over and over. The ARRL *Handbook* was like a bible. My first rig was a 15 watter called *The Bare Essentials Ham Transmitter* by W5LET in the March 1968 edition of *Electronics Illustrated*. It had a single 50C5 vacuum tube and coils wound around a medicine bottle. My receiver was an SX-28. Everybody knew more about ham radio than I did.

Thinking back on those days, I was inspired by one special lady Amateur who taught me more than she would ever realize, and about how this hobby affects its participants.

Twenty-nine years ago, my father took me along on an evening visit to his friend Bill Randall's house to get help working on our car. An antenna tower loomed above the driveway as we pulled up. While dad and his buddy were involved in the garage, I wandered inside the house to discover an Amateur Radio station that filled a room. It belonged to Mrs. Randall, not Bill.

Mary Randall, WA6VDS, was paralyzed from the neck down. She had been diagnosed with progressive full-body polio about three months before the Salk vaccine was approved for distribution in the '50s. She slept in an iron lung.

On a good day, she could spend a few hours in a clam-shell respirator strapped to a wheelchair. With me as a wide-eyed visitor, a live-in nurse wheeled her into the radio room to the front of her equipment. The station was adapted with oversized knobs that could be spun with a rubber-tipped wand she held in her mouth. Amateur Radio was her connection to the outside world.

When we first met, a funny feeling settled in my stomach, but she introduced herself and set about checking into an 80-meter "ragchew" net with no mention whatsoever of her overwhelming handicap. Quickly my attention was diverted from the rhythmic wheeze of the respirator and un-wrinkled skin on her lifeless hands, to the distorted sound of people speaking directly to her from the speaker.

"Tune that in for me, will ya?" She asked between breaths. "Just move the knob slowly till it sounds natural." From the screechy tone of Donald Duck to the bassy rumble of Lurch, I over-controlled the half-kilowatt Swan 350 single side-band transceiver several minutes before human sounding voices returned. She told everybody on frequency there was a 10-year-old guest in her shack: me. That night I had mike-fright, but later I overcame it. Unlike television, those people spoke to me and waited for a response. From that time forward, Mary Randall remained an influence in my life.

Within two years I was a crystal-controlled, 75-watt, CW only Novice. Electronics eventually became my first career. As my interest in Amateur Radio and knowledge grew, we kept in contact through this hobby on the air. But in time, my circle of Amateur friends grew and my interests diversified. Occasional QSOs with Mary grew fewer and farther

(Continued on page 21)

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What Is Field Day? It's More Like An Event Than A Contest!

by Joe Lynch, N6CL

As a new Amateur Radio operator, one of the first contests you may be exposed to is Field Day. It was originally conceived sixty years ago as a way of testing equipment and training operators for emergency preparedness. Field Day is one of the most popular contests in Amateur Radio. But as an event, it often includes the whole family participating in a weekend-long campout centered around the hobby.

When Is It?—The contest takes place annually on the fourth weekend of June. This year's contest is scheduled between 26-27 June, from 1800 UTC Saturday to 2100 UTC Sunday. The primary objective of the contest is to operate your station from a portable location or to operate under less than normal circumstances.

What Are The Rules?—There are a number of categories, classes and several rules that are designed to create incentives for encouraging a variety of ways of communicating. The various categories include: Club/Non Club Portable (class A); One or two Person Portable (class B); Mobile (class C); Home station (class D); and Home Station Emergency (class E). The Club/Non Club and the One or Two Person Portable categories are further divided into Regular and Battery categories. To be eligible for the Battery categories, these stations must run no more than 5 watts output and use batteries or other non-commercial means (such as solar cells) or be hand-powered or powered by water-driven generators. The Class you enter is determined by the number of operating positions you will use simultaneously.

The special rules provide the ability to earn up to 100 bonus points for each of the following: operating from 100% emergency power; generating publicity in local news media; locating in a public place, such as a city park; setting up a display promoting Amateur Radio in a public place; originating a message from the Field Day leader and sending it to the Section Manager or the Section Emergency Coordinator for the ARRL section; relaying messages from other Field Day stations to the SM or SEC (10 points each, to a maximum of 100 points); making a minimum of five contacts from an Amateur Radio satellite; making a minimum of five contacts from a station using "natural power", that is by alternate means, such as solar, wind, methane, or grain alcohol, or batteries charged by such power sources; receiving the W1AW Field Day message; making at least one packet radio contact; and, new this year, making at least ten contacts on VHF and above Amateur Radio frequencies. Many of these incentive rules exempt the operating positions used from the total number allowed for the class entered.

> Field Day is one of the most popular contests in Amateur Radio. But as an event, it often includes the whole family...

Another incentive available to the Club/Non Club Portable category is the separate Novice/Technician station. This station is set up and operated by only licensees of these classes. It is considered a separate operating position but does not count toward the total operating positions allowed for the class entered. Additionally, it uses the callsign of the Novice/Technician class as a way of differentiating it from the rest of the other stations.

How Do You Participate in Field Day?—First, choose which category that you wish to enter. If you belong to a club, encourage your club to organize a field day plan. If you are not going to participate with a club, then you may want to choose from the several other categories. You and a friend may choose to operate together at a portable location. You may want to go mobile or you may want to stay home and operate your station using emergency power.

Once you make your choice of category, then choose how many operating positions you will have on the air at the same time. This will decide which Class you enter and the exchange that you use for making your contacts. If you are with a club and they are operating from a portable location, using three different transmitters simultaneously, you are in the Three Transmitter Class. *Note: Many of the incentive rules exclude the transmitter used for such contacts from the total count.* It is important to

Field Day is as much a family event as it is an Amateur Radio contest. Members of Oklahoma City Autopatch and their families enjoy pizza during their 1992 Field Day operation. Photo courtesy KF5JN.

check the rules before determining the final count of operating positions used simultaneously.

Next, decide what equipment you will use (including camping equipment, if necessary). Plan out everything in advance. Be sure to allow for spares for everything because the nearest radio store may be very far away.

Then, decide when you want to set up your station. While the contest runs for 27 hours, if you start your station set-up before the beginning of the contest, you can only operate for 24 hours.

Finally, determine what will be your exchange. It is simple and consists of two parts, the Class and the ARRL/Canadian Section.

If you are using three operating positions simultaneously and are operating as a club from a portable location, then you are in the "A" class. You determine your section by consulting *QST* to ascertain which section your geographic location falls within. For example, if you live in El Paso, you are within the West Texas Section. Therefore, your exchange is "3A West Texas" on voice, or "3AWTX" on CW. Note: No signal report is required within the exchange. (If you have doubts about which section you fall within, call the Section Manager listed on page eight of any issue of *QST*.)

Operating a Field Day Station—This will expose you to operating in a contest. You may find this an interesting and challenging aspect of the hobby.

Additionally, you may be able to operate on Amateur Radio frequencies you may not normally work. For example, if a control operator of a higher class license than yours is in control of the station you are operating, you can operate on the frequencies authorized to the control operator while under his or her supervision.

Finally, it can also prepare you to operate under emergency conditions. Emergency preparedness? Yes! Last year's Field Day included two earthquakes in Southern California that found Field Day operators participating in "the real thing". Earthquakes in Idyllwild and Big Bear, California, early Sunday morning provided real opportunities to furnish emergency communications and back up communications for several municipalities and other entities affected by the quakes. Field Day operators and stations already set up provided an instantaneous pool of personnel and equipment available for service during the emergencies.

Want More Information?—Check the May *QST* for the complete rules. Send to the ARRL (225 Main St., Newington, CT 06333) for the *Field Day Package*. The experience and training you receive from operating Field Day will be invaluable as you expand your Amateur Radio horizons.

Want More Inspiration?—Ask any old-timer to tell you about his or her first Field Day. That gleam in his or her eyes will tell it all.

73, de Joe, N6CL ❑

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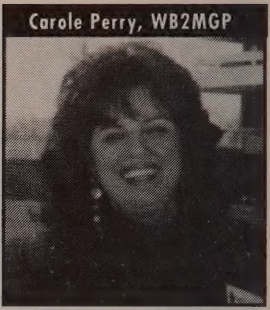

Carole Perry, WB2MGP

Home Sweet School

by Carole Perry, WB2MGP

AS AN EDUCATOR, I'm always interested in finding out more about alternatives to conventional education in this country. Last year, through a chance encounter on the "CQ All Schools Net" I met three terrific young ladies who were participating in Home Schooling in Houston, Texas. As a result of my weekly contacts with Shalon, Linda, and Marie Giesen, both my students and myself learned a great deal about this educational system, and the role Amateur Radio could play in it.

The latest statistics show that there are more than 300,000 students who are presently being educated at home. About 75 percent of home schoolers are conservative Christians who stress the Bible in their teachings and who lament what they see as a decline in traditional values in the public schools. Others are of the belief that public schools don't set high enough academic standards. But all home schoolers seem to share the belief that education is integral to family life.

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Shalon, KB5OMY, and Linda, KB5PDW, and Marie, KB5OPB are delightful regular check-ins on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz with Gordon West, WB6NOA and myself. These three sisters enlightened us about the role of Amateur Radio in their home studies. The girls, parents and uncle Bernie saw the value of Amateur Radio in helping to improve the girls' test- taking skills, learning of geography, and sharpening of spelling techniques. My 6th, 7th, and 8th graders always enjoy chatting with the girls and sharing learning experiences with them.

Meet Tim Tye, KB5SBY, a new Advanced class ham at age 14.

This year on the net, I was especially delighted to have a contact with Tim Tye, KB5SBY from Krum, Texas. Tim is such a proficient radio operator at the tender age of 14, that I often rely heavily on him to act as a relay when conditions aren't favorable on 10 meters. Tim is also a home schooler.

Tim became interested in ham radio after his dad bought him and his brother a shortwave kit for Christmas two years ago. Tim assembled it and strung up a wire antenna to the backyard swingset. His interest grew as he listened to stations in Cuba, the Soviet Union, and other DX locations. When a family friend, Steve Williams, KB5KNN, helped him fix a problem on the radio, Tim began thinking about ham radio.

The next day, at church he met Jim Bryant, N5ZAV, the assistant scoutmaster of the local troop in Sanger, Texas, who along with Wes Atchison, WA5TKU, was teaching a no-code Technician class. They invited Tim to join, and the two quickly became his "Elmers," according to Tim. Thanks to the encouragement and instruction provided, most of the kids in the troop got their tickets and were soon on the air.

Tim's parents encouraged him to upgrade so he could benefit educationally from being on the low bands. They saw the advantage to youngsters in learning geography and electronics via Amateur Radio. Tim agrees with me that kids who learn about different parts of the world through their radio contacts are really learning geography on a need-to-know basis, and are more likely to remember the information. A typical school day for Tim and his brothers includes Bible, Algebra 1, Earth Science, World History, Literature, Grammar, and Computer. After his studies are completed, he always finds time to get on the airwaves, and in addition likes to experiment with different types of antennas.

▼

> As an educator, I'm always interested in finding out more about alternatives to conventional education in this country.

This bright young man has passed his advanced license exam and the 20 WPM test. He plans to try for the Amateur Extra ticket in February. Tim tells me that his favorite activities in ham radio include: DXing, completing his WAS, participating in the YL International Single Sideband System, the 3905 Century Club Net on 40 meters, and he especially looks forward to the CQ All Schools Net.

Tim thinks that ham radio is a "natural" for those who choose to home educate. He likes the idea of being able to develop skills in meeting new people and learning how other people live. My students and I look forward to speaking with Tim every Tuesday and Thursday. He is obviously from a caring, innovative family who are concerned about the quality of their children's education. How fortunate for us that we can share some of their experiences through ham radio.

Tim Tye is one of several youngsters I have selected to do a presentation at the Youth Forum at the Texas HamCom on June 5th this year in Arlington. Come on down and join us and meet with Tim and the other children who are going to be the future of Amateur Radio.

73 from Carol, WB2MGP ❑

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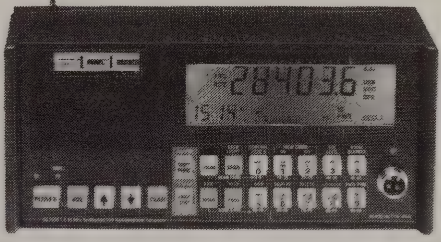

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THE • ADVENTURES • OF

Dan & Burke

The Electronic Eraser

Dan, Burke, Police Chief Morton, and a pale, young, well-dressed stranger were engaged in serious conversation in the boys' basement laboratory.

"I need rather specialized help in a hurry," young Mr. Adams was saying. "I just talked to the department head of the Federal agency for which I work and explained the situation to him. When I told him where I was, he remembered that you boys had helped another of our agents about a year ago. He says you designed a small transmitter that fitted inside a dog's collar and enabled our guy to get some valuable information."

"Sure; that was Mr. Cody, a big fellow who was light on his feet and gave out next to nothing in the way of information," Dan recalled.

"Sounds like agent Cody," the pleasant stranger said with a wan smile. "Anyway, I was told to contact you through Chief Morton and see what you could do. I'm afraid, like Mr. Cody, I can only divulge just the information you must have to understand the problem; but believe me, this affair is important to every living American.

"Tonight at ten a man will board a bus leaving for Center City. He will be carrying a small tape recording, probably in a briefcase. On the bus will be another man waiting to receive the tape. After it changes hands, the receiver of the tape will somehow check the recording to make sure it's what he wants. If he is satisfied, a large sum of money will be given to the man who surrenders the tape."

"Now it's most essential, first, that the men do not know they are under surveillance; second, that the tape not change hands; and third, if at all possible, that the tape itself be destroyed. Can you men, with your background of electronics, think of any way these three objectives might be accomplished?"

"Am I right in believing it's the material recorded on the tape that you don't want to change hands rather than the physical tape itself?" Burke asked.

"That's right, but what are you driving at?"

"I was thinking of some method by which we might erase the tape without its ever leaving the possession of the man who has it now."

"And without his knowing that it was being erased?"

"Yes," said Burke. "I'm not at all sure it can be done, but suppose you give Dan and me about three hours—let's say until 8 PM,—to do some experimenting. In the meantime, perhaps you'd better think up a second plan to use in case we strike out."

"I like the way you think-" Mr. Adams started to say as he rose to his feet, but suddenly he gasped and nearly doubled over in pain. "Guess I got kind of a catch in my side," he explained as he straightened up. "I'll be back at eight to see what you've found out, but I surely hope you come up with something. I don't seem to be thinking too well today, and I ran out of ideas before I came here."

"Sounds to me as though you're biting off quite a chunk, old buddy," Dan observed after the other two had left. That business about the men not knowing any hanky-panky is going on while their precious tape is being erased is the toughie. What do you have in mind? Rubbing a big permanent magnet over the guy's briefcase?"

"It's worth trying," Burke answered promptly. "Let's do some experimenting and see what kind of results we can get with brute force DC. erase—that's the name applied to using a permanent magnet to erase a recording from a tape."

It didn't take the boys long to convince themselves that this approach showed little promise. A very strong alnico magnet out of a speaker had to be almost in contact with the tape to erase the recording completely. When a quarter-inch of space was kept between the magnet and the tape cassette, only a very slight weakening of the recording was noticed.

"I was afraid of that," Burke observed. "We must be able to work through a distance of at least a quarter of an inch to allow for the thickness of the leather in the man's briefcase, a plastic container for the tape, etc. You see, a DC erase system on a tape recorder doesn't consist simply of a method of passing a tape over a strong permanent magnet. That's only the first step, which leaves the tape in a very strongly magnetized condition. It must then be passed over a weaker magnet of opposite polarity, or sometimes several magnets of alternating polarity or a magnet with a diagonal gap in it, so that the end result is a tape which is completely demagnetized. That's what we need, some way of literally bathing the recording right through the briefcase with an alternating, diminishing magnetic field."

"And how do we do that?"

"Let's try to construct a portable, battery-operated bulk eraser. As you know, a bulk eraser is simply a strong electromagnet with 60-cycle AC going through its coil. As a cassette tape is subjected to this strong reversing field and then gradually withdrawn, the little magnetic particles of the tape are first jerked violently in unison out of their recorded pattern and then are subjected to weaker and weaker pushing and tugging forces that eventually leave the maganetic particles lying in the disarray of virgin tape."

"Don't you think it's going to be a little difficult to get AC out of your batteries—or are you going to use AC batteries?"

"Don't be cute. We can get a first cousin of AC, *pulsing DC*, simply by using an interrupter between the batteries and our coil," Burke retorted. "Suppose you see what you can do about converting this old six-volt auto radio vibrator into a simple interrupter while I get started winding a magnet."

Burke started by boring a small hole in the center of a two-inch diameter, one-inch thick piece of soft iron; a bolt passed through this hole was able to hold two circles of plywood clamped against the sides of the iron core. Next, he cut several short pieces of plastic electrician's tape and looped them down into the space between the two pieces of plywood with their sticky sides turned away from the wood and iron. Then he chucked the end of the bolt in his electric drill and wound layer after layer of #20 enameled wire on the core.

Burke did his best to wind the wire in tight, even layers as the electric drill rotated the core, and he kept at it until his bobbin of wire was some five or six inches in diameter. Next, he carefully lapped the loose ends of each piece of tape over each other to hold the wire securely in place while he removed the wooden sides and pushed the iron core out of the middle. Now, very carefully, he wrapped the whole doughnut of wire with thin plastic tape and then forced the soft iron core back into the center.

By this time Dan had the vibrator reworked, and it was connected to a battery eliminator and the coil so that the heavy contacts of the vibrating reed connected and disconnected the six-volt DC supply to the coil at a rate of about 115 pulses per second. A capacitor substitute box was connected across the points of the interrupter and adjusted for minimum arcing; then a capacitor of this value was soldered in place.

Finally, the boys placed an issue of *QST* on top of the coil, laid a cassete on top of that, and turned on the battery substitute. The tape was slid around on the magazine for a few seconds and then lifted away before the power was cut off. When the tape was placed on the recorder and run through in the *PLAY* position, not a sound—except for a slight hiss—came from the recorder speaker.

"That does it!" Burke exclaimed jubilantly. "Now let's get busy installing this rat's nest and some parallel heavy duty six-volt lantern batteries in that old attache case of my dad's. We want plenty of current, for the magnetic field is dependent on ampere-turns. Mr. Adams should be here in an hour, and I want to be able to give him a convincing demonstration."

First they cut a hole in the side of the case so that one side of the coil could be mounted flush with the surface of the leather. This opening was concealed with brown press-on paper that was used to cover the entire case. The batteries were anchored in place, and the vibrator was wrapped in several layers of sound-insulating foam rubber. Wires were run through the handle to a simple push-button switch which could be operated easily with one finger.

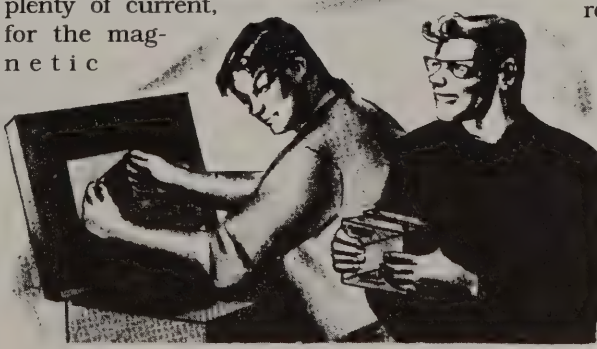
"We want to have our magnet as close as possible to the cassette," Burke said as he smoothed the thin paper over the magnet core. "The strength of a magnetic field is inversely proportional to the distance, and it works on a square law. Plus or minus a sixty-fourth of an inch might spell the difference between success or failure in our completely erasing that tape."

He was interrupted by the arrival of Mr. Adams and Chief Morton. The former looked even paler than he had that afternoon, and bent over a little.

Quickly the boys explained what they had done. They let Mr. Adams hear a few feet of recorded tape and then placed the cassette in a briefcase. While Burke walked around the basement dangling this case from one arm, Dan brushed against him with the attache case. In spite of what seemed to be a very brief and casual contact between the briefcase and the attache case, the tape was found to be completely blank when it was placed on the recorder.

"Guess we better show you how to work it; we haven't much time," Burke offered.

"Boys, I have bad news for you," Mr. Adams said as he wiped cold sweat from his forehead. "You're going to have to use that gadget



yourself. The doctor is waiting for me in a squad car outside, and I must go straight from here to the hospital for an emergency appendectomy.

"This is a picture of the man who will have the tape," he went on. "You should be able to spot him in the bus station. And here are two round-trip tickets for the bus to Center City. Good luck!"

With that, Chief Morton half-led, half-carried Mr. Adams through the door and up the outside basement steps.

Meanwhile, Dan and Burke stared at each other in pop-eyed amazement. "Well," Dan finally said, "I guess we better get started. You wrap up in your cloak while I dash over and get my dagger!"

In spite of their joking, both boys had a feeling of rising excitement as they parked their car across the street from the bus station.

They spotted their man as soon as they entered the door, even though he was not wearing dark glasses, had no beard, and looked amazingly like any ordinary businessman. But he also happened to look exactly like the picture in Burke's shirt pocket, and a thin briefcase rested on his knees. Out of the corners of their eyes, the boys could actually make out the outline of the plastic tape box through the leather.

It seemed to Dan and Burke the bus would never come, but finally it did. As the stranger stood up with his briefcase in his right hand, Burke transferred the attache case to his left hand and followed the man closely. At the door of the bus there was a little knot of people awaiting the alighting passengers before they started getting on, and it was here Burke had his chance.

While Dan stood on the man's left and asked him something about whether the bus was on time or not, Burke pushed the switch under his finger and brushed his case lightly against the briefcase, rubbing it around with a circular motion. The man never noticed.

The bus was not crowded. Dan and Burke followed their man to the rear, where he selected a seat beside a short fat man who was dictating letters in a low voice into the microphone of a cassette recorder.

The two men apparently took no notice of each other until the bus was a dozen miles out of town. Then the man with the briefcase turned to the other and said, "Pardon me, sir, but I wonder if you might do me a great favor. I have a tape here sent me by my nephew in the army overseas, but I don't even have a Sony *Walkman.* Could you possibly let me hear it on your recorder?"

"Why, certainly; just let me have it and I'll get it started for you," the fat man answered obligingly.

As Dan and Burke watched tensely, the fat man took the cassette from the briefcase and put it in the machine. Then he put the listening earpiece in his ear and started the tape moving. After a few seconds he began to frown and he threw a switch that sent the tape whirring at a faster speed. Next he turned the tape over and tried to listen to the other side. Finally he handed the earpiece to the first man and said coldly, "Your nephew is a practical joker. There is absolutely nothing on that tape. Hear for yourself."

The man trying to sell the tape listened to e very inch of it with growing puzzlement and dejection. "I don't understand it; I don't understand it at all," he muttered over and over.

"You'd better tell your nephew practical jokes can be dangerous," the little fat man said menacingly as he turned his back and stared out the window.

After arriving in Center City, Dan and Burke followed their man outside the bus station. As he walked past an alley, he impulsively tore the cassette from his pocket and tossed it into an ash can. The boys retrieved it and took the next bus home.

Chief Morton was waiting for them at the station, and the three of them went to the hospital. There Mr. Adams was out from under the anesthetic, and he was delighted at what the boys told him.

"Well done!" he said weakly. "If this keeps up, we're going to have to put you on our payroll. Seriously, though, you'll hear more about this as soon as I'm back on my feet and send in my report. In the meantime, boys, you've done a great service for your country—greater than you realize."

"As far as I can see, all we've done is get tangled up in some more government tape," Dan said jokingly as they headed for the door, "but at least it's not red!"

Dan and Burke is based on a storyline created in 1954 by John Frye, W9EGV. The boys are the sons of John's original characters, Carl and Jerry.

John Frye is no longer with us. But while he was alive, John was an avid Amateur Radio operator who wrote about young people—for young people.

It's doubtful that anyone could make John's stories more interesting or improve on his words. We'll settle for giving them a 1990s twist.

If you would like to learn more about becoming an Amateur, or helping a young person become an Amateur, write to the National Amateur Radio Association, P.O. Box 201407, Arlington, TX 76006 or call (800)468-2426.

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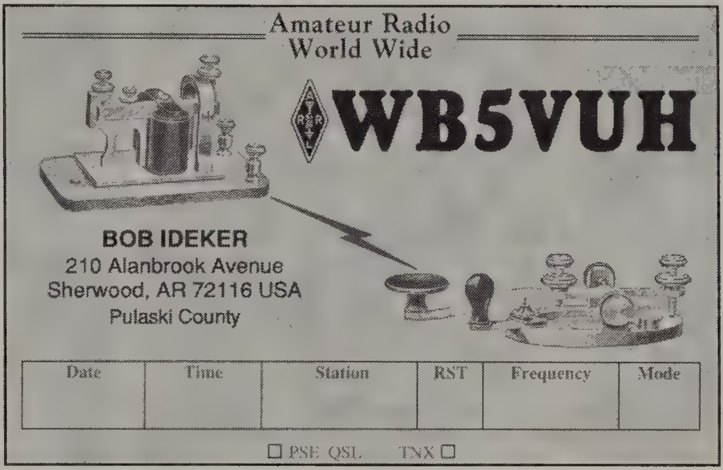

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Don Stoner, W6TNS, has just finished a new booklet called *"Understanding Your Handheld Radio."* It explains, in simple terms, what all those knobs and rubber buttons are used for. The following material is a sample portion of the first chapter.

Chapter One-Beginning Handheld

THE FIRST THING one sees when they unwrap that sparkling new handheld radio is a dazzling array of knobs and buttons, along with a document that purports to be instructive. Browsing through the pages makes it appear someone has mixed this material with the pilots training manual for a Boeing 747.

But don't despair! In this book, we'll break down the operation of your "747" into smaller, more digestible bits. Let's start with some of the simpler points.

The Kenwood TH-77A is one of the most popular dual-band handheld radios.

THE STUFF ON THE TOP

The Volume Control—One would think the volume control does not require any explanation. But in the world of handheld radios, this is not necessarily true.

First, your handheld contains a "teensie-weensie" speaker, smaller even than those in most portable radios. One mistake newcomers make is to clip the radio on their belt and then turn up the volume, just short of blasting, so they can hear it even in a noisy environment. This is brutal punishment for the speaker, not to mention that it is annoying to others in the area. In this situation, it is better to use a tiny plug-in earphone which will mute the speaker. These are available as optional accessories for most handheld radios.

There is another reason for keeping the volume low on your handheld. I've never seen it mentioned in a manual, but high volume increases the battery consumption *noticeably*. At full volume, you are jamming about one-quarter watt into the speaker and sucking many milliamperes from the battery. There are too many variables to predict how much battery discharge will occur. But take my word for it, you will have to recharge the batteries more often if you operate the radio at high volume.

The Squelch—By now, you've undoubtedly turned the radio on with the squelch control improperly set. Every manual says "*set the squelch*" but none tell you just exactly how you are supposed to accomplish this wonderful feat. They assume you know.

That hissing noise you hear is the background static of the radio when no signal is present. You would not want to listen to that racket all the time, so the radio incorporates a circuit to silence the speaker when nothing but noise is present. This is called the *squelch circuit*. It is really a *noise switch*. When a signal comes in, it will decrease the hissing noise. The stronger the signal, the lower the level of hiss. By measuring the noise, and using its value to control the sound switch, the hissing sound can be squelched off.

Here's how you set the squelch. Turn both the volume and squelch knobs full counter clockwise. Then rotate the volume knob clockwise until you hear the hissing sound made by the receiver noise. Now, rotate the squelch knob clockwise until the speaker suddenly goes silent. Just a "hair" past this point is the correct setting for the squelch. Now, when a signal comes in it will open the receiver sound so you can hear the person talking. You will probably have to advance the volume somewhat for a normal listening level.

Tight and Loose Squelch—Another thing the manuals don't mention is setting the squelch "loose" or "tight." When you set the squelch as just described, even a very weak station can open the sound switch. This is called setting the squelch "loose." If the radiation from your TV, your computer or other local sources of interference opens the squelch with no signal, you may want a "tighter" setting. Do this by rotating the squelch knob more in the clockwise direction. The more clockwise you set the knob, the stronger the signal that will be required to open the sound channel. Most radios will still unsquelch even with the knob set to full clockwise, but it will take a very strong signal to do so.

External Earphone And/Or Microphone—Almost all handheld transceivers have provison for an external mike and earphone. There will usually be one or two holes in the top where these accessories can be plugged in.

These are called *jacks*. The earphone jack usually requires a 1/8-inch two-circuit *miniplug*. You can connect the plug to an old earphone you might have laying around, if you don't want to buy the manufacturers accessory earphone. Why would you want an earphone? Refer to my comments in the "*Volume Control*" section regarding its use.

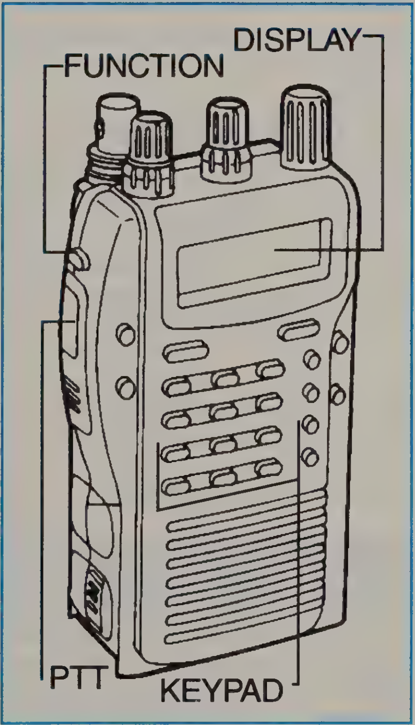
You can also connect an external microphone to one of these connections. To understand why you might want to do this, refer to the section on "*Accessories*."

Finally, you can use the earphone and microphone jacks to connect your handheld to a device called a *Terminal Node Controller*, or *TNC* for short. This interfaces your handheld to your computer and allows you to send and receive messages by packet radio.

A "Rubber Duckie?" You're Kidding, Right?—This is probably the right place to talk about the antenna used with the handheld radio. The antenna is almost always a flexible rubber thing measuring four to six inches long. More often than not, it is referred to as a "**rubber duckie**." This is one of the quirks of ham radio lore—to name an antenna after a childrens' bath toy—and proves hams have a sense of humor. I believe a manufacturer, who first introduced flexible rubber antennas, named their product a "rubber duckie." Appparently they neglected to copyright the term. This type of antenna became known as a "rubber duckie" as a generic term, much like Kleenex is a generic term for disposable tissues.

The Antenna Connection—There's one more "gizmo" on the top of the radio that should be mentioned. It is a round object, about 3/8-inch in diameter. The antenna drops down on this and twist clockwise a quarter turn. This locks the antenna in place. The connector is referred to as a BNC type, which is some leftover military jargon. You can remove your "rubber duckie" by twisting the connector a quarter turn to the left.

Not only does this connector serve as a mount for the antenna, but it is also provides the input/output point for an external antenna such as a beam or direction finding attachment.



Drawing courtesy of Alinco, Inc.

THERE'S MORE STUFF ON THE FRONT

What Are Those Rubber Buttons?—They are *switches* that control some action of the readio when the contacts are opened or closed. Buttons on the front of the handheld, are usually arranged in a pattern and perform various functions. More button switches on the side of the handheld, perform other functions.

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On the bottom of the rubber button, inside the radio, is a spot of conducting carbon. When you press the rubber membrane, the carbon spot connects two conducting points or contacts, which closes the switch. The contacts are then connected to a tiny single-chip computer (sometimes called a CPU or central processing unit) inside the radio. Essentially the CPU controls the functions of the radio.

Hams Do It With A Keypad—The most important group of switches is called the keypad. This is an assemblage of rubber button switches laid out approximnately the same as the keypad on your telephone. The keypad usually has several functions which will be discussed throughout this book.

(Continued on page 22)

NARA Reviews Alinco's DJ-180 2-Meter Handheld Radio

by NARA Staff

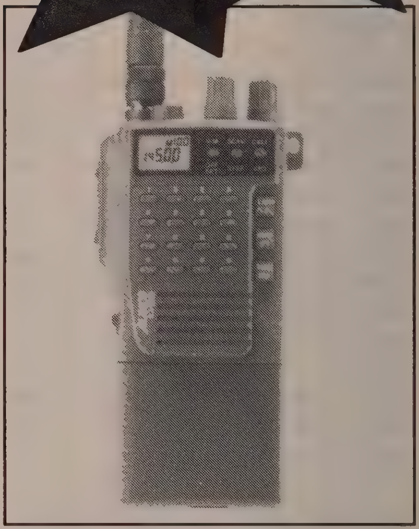
AMATEUR RADIO
AWARD OF EXCELLENCE
NARA

NEW AMATEURS ARE often fascinated by today's super-featured FM handhelds. But beginners prefer a more economical and easy-to-understand rig for their own personal use (I am a newcomer, not a nuclear scientist!).

Alinco apparently considered that fact when they developed the DJ-180 2-Meter handheld transceiver. It has everything you could want or need, except a high price tag and complex functions requiring step-by-step instruction manual guidance. You just switch it on, tune in a repeater, punch up a Tx offset ("-" for repeaters outputting below 147 MHz, "+" for repeaters above 147 MHz), and press the PTT switch to transmit. This palm-size transceiver *is not limited* to basic operations, however. It will scan its memories or the full band, has a front keypad for autopatching, built-in CTCSS encoder and decoder for accessing PL-equipped repeaters and silent monitoring, plus an automatic power-off function. It also has selectable VFO tuning steps, backlit frequency display, PTT and dial locks, and a "call" button for quick-shifting to your favorite repeater. The DJ-180 packs a lot of high technology in a small package!

The DJ-180 is fitted with a dark gray high-impact plastic case measuring 5.2 by 2.3 by 1.3 inches H,W,D. It comes with a 7.2 volt/700 mAh rechargeable battery pack, short flexible antenna, belt clip, wrist strap, and drop-in battery charger. Frequency coverage is 144 to 148 MHz "right out of the box." A two-second "button mod" adds reception of the 150 MHz public service and 162 MHz NOAA weather bands. This one-time mod involves nothing more complicated than holding the "lamp" button depressed, while switching the radio "on."

> Our on-the-air study of Alinco's DJ-180 confirmed it is an ideal 2-meter handheld for beginning Amateurs.


Alinco's new DJ-180: a neat 2 meter handheld at economical cost.

As factory-supplied, the DJ-180 has 10 memories you can program with any repeater frequency and transmit offset. Ten memories are quite adequate for most local area operations, but you can expand the memory channels to 50 or 200 by adding Alinco's EJ-14U or EJ-15U (respectively). These tiny expansion boards snap into sockets inside the DJ-180. The handheld's power output is two watts, and a low power of 0.5 watts is button-selectable for minimizing battery drain. Prefer more output power? Just add Alinco's optional 12 volt/700 mAh battery pack (EBP- 28N) to the DJ-180, and you have a full five-watt signal for reaching distant repeaters. Nice!

Our on-the-air study of Alinco's DJ-180 confirmed it is an ideal 2-meter handheld for beginning Amateurs. Frequencies are easily tuned by the top knob, and steps of 5, 10, 12.5, 20, and 25 Hz are selectable to accomodate the activity in your area. The 10 kHz step works great for quick-tuning popular channels like

146.76, 146.88, 146.94, 146.98, etc. Front panel buttons are color-coded for easy use: white is their "normal" function, and blue corresponds to their function when the rig's left-side "*Function*" button is held depressed. You press the "*V/M*" button for VFO mode, tune in a repeater, then hold the "*Function*" button and press the "*V/M/Offset*" button to set the transmitter offset. Likewise, pressing the "*Scan*" button starts scanning while holding "*Function*" and pressing "*Scan/Step*" lets you select tuning steps. Other front buttons work similarly. The DJ-180 "explained itself" so well our we could activate and use all of its special features (except programming the call channel) even before reading the manual. We next tried autopatch telephone dialing on a local repeater with the DJ-180, and it worked great the first time!

The DJ-180 is set up to scan its full VFO range (or memories if you select "memory" mode), pause on a busy channel for five seconds, then continue scanning. When it pauses on a channel you wish to continue monitoring, just press the PTT switch to cancel scanning. If you wish to scan only a particular range (like 146 to 147 MHz), simply turn the top tuning knob "two clicks back" when scanning reaches 146.99 or 147.01 and "two clicks forward" when scanning approaches 146 MHz. Likewise, continuously busy channels can be manually skipped by turning the top tuning knob one or two clicks when scanning pauses. Actually, "manual control" of these frills is more convenient than programming and using a "complex handheld."

The DJ-180's automatic power-off function is a real blessing when you forget to switch the handheld off after use, and do not think such an oversight could not happen to you. Let's say a friend calls on a simplex frequency while enroute for a visit. When they arrive, busy excitement sets in while your rig's battery pack fades to depletion. Not with the DJ-180. After 30 minutes of silence, it plays a short tune and switches itself off. When you later pick up the radio and turn its switch off and back on, regular operation continues.

The built-in CTCSS (subaudible tone) decoder is a special treat not factory included in many other handhelds, and it is great for silent monitoring. Here's how it works. First you set a decoder tone (like 67Hz), and tell your friends to set the CTCSS encoder in their rigs to the same tone (67Hz, for example). You then select a mutually-agreeable monitoring frequency (like 146.52 simplex). Your DJ-180 then sits absolutely silent until receiving a "CTCSS" call, at which time a friend's voice breaks the silence. This feature must be used to be fully appreciated. It is terrific! We also like the DJ-180's bright backlit display for night use (easy to read in the dark) and its PTT and dial locks. This is nice for showing the handheld to friends. They cannot accidently transmit or change frequencies.

Finally, we must compliment the DJ-180's high performance receiver, cool running transmitter and great sounding audio. It copies fringe area repeaters like a pro and has good sensitivity across its full range. The back cover barely gets warm during long transmissions at high power. Very impressive!

Alinco's DJ-180 checks out as a super go-anywhere 2-meter FM handheld with just the right features, an attractive price and a full one year warranty. It is the first product to receive NARA's *Award of Amateur Radio Excellence*. The DJ-180 is supported with a full line of accessory battery packs, a vinyl case, and a rapid battery charger. For more information, contact your nearby Amateur Radio dealer or write Alinco Electronics, Inc., 438 Amapola Avenue, Suite 130, Torrence, CA 90501, for a brochure on this product.

73s from NARA Staff ❑

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AWARD FOR EXCELLENCE

The National Amateur Radio Association is pleased to announce the introduction of their *Award of Amateur Radio Excellence*.

There are a few products on the market that represent outstanding bargains, or exceptional value, performance and usefulness to beginners. NARA believes these products should be recognized and recommended to our members.

The first such product meeting this criteria is the Alinco DB-180, reviewed in this issue of *The Amateur Radio Communicator*. This two-meter handheld has all the features a beginner could want and yet, it is one of the lowest priced handheld radios on the market.

It should be stressed that the award is not an advertising gimmick. One need not be an advertiser in *The Communicator* to be recognized for excellence. Rather, we look to our members to recommend products which, in their opinion, meet the criteria of "outstanding bargain and/or exceptional value, performance and usefulness to beginners."

Manufacturers who receive the National Amateur Radio Association's *Award of Amateur Radio Excellence* receive a plaque which can be displayed, along with the right to use the award symbol in advertising for that product.

Should We Inform Other Hams When They Violate The Five Principals of Amateur Radio?

by Larry Luchi, W7KZE

AS AN ARRL Official Observer and a licensed ham for nine-tenths of my life, I could not agree more with NARA's approach to respect the No-Code Technician license and enforcement of FCC Rules and Regulations. In connection with this, let's look at a recent FCC enforcement action.

Richard Whiten, WB2OTK, A General Class Amateur

The Kingsville, Texas, office of the FCC sent a Notice of Apparent Liability (NAL) to an Amateur Radio operator in the amount of $10,000.

Richard Whiten, WB2OTK, 46, of Taylors, South Carolina, was cited for "willful and malicious interfering transmissions" monitored by the FCC on Sept. 26, 1992, on 14,314.7 kHz.

In Whiten's reply to the FCC's NAL, he did not (according to the Commission) dispute making the transmissions. But he "denied that his signals constituted willful, malicious interference, because, he said in his letter, "if he truly wanted to willfully and maliciously interfere he could have done so to such an extent that the communications between other Amateur Radio operators would have been impossible, that his comments were not disruptive, that his statements were innocuous, that he was recognized and spoken to by other Amateur operators, and that he was the victim of entrapment by other operators."

The FCC's "base amount" fine for willful interference is $7,000; in Mr. Whiten's case his fine was raised almost 50 percent in view of his third NAL (one on January 28, 1991, and July 12, 1991) for the same rules violation.

Let's review the third Principle, from Section 97.1 of the Amateur rules: *Encouragement and improvement of the Amateur Service through rules which provide for advancing skills in both the communications and technical phases of the art.*

My first call-sign was WN7DQI, the "N" indicated Novice and the only way I was able to upgrade was by participating with the "old-timers" (I nine—they were old) on Field Day and other club events. The Novice license was valid for one year so we had to use the rules that allowed us to *advance our skills in both the communications and technical phases of the art.*

The same Section 97.1 of the Amateur rules says: *Continuation and extension of the Amateur's unique ability to enhance international goodwill.* Often the signals we transmit on the HF bands can be heard in overseas countries!

We all had to start somewhere in this hobby. I was a Novice. Others who sat at the FCC offices for their test went from no license to Extra in one sitting. Why are some hams dividing the accomplishments of others with the status thing of No-Code Tech versus Code-Tech (or Tech-Plus, as it is called)? Both groups are Amateur Radio operators, and as such deserve the right under Section 97.1 of the Amateur rules to the extension of the Amateur's unique ability to enhance international goodwill. After all, we all started as a neophyte in this fine art. My father, Ray, KB7POZ, is a No-Code Tech. He deserves the same encouragement and help as I did as a neophyte. The difference is that he was 70 years young when he passed his exams—I was nine!

73 de Larry R. Luchi, W7KZE ❑

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LETTERS

THE DINOSAUR PATROL

Mr. Stoner:

I am sure you are the same person who made the super regenerative CB set that was widely duplicated by CB'ers around the country. And now you encourage everyone to get on six meters. It is bad enough that they no longer have to "earn" a license by learning Morse code... it is practically a give-away to anyone who can memorize answers. Frankly, as far as I am concerned, you are still one of those pious self-satisfied do-gooders that we can do without. No, I am not bitter, just disgusted with this free give-away attitude that so many people have nowadays. Everybody seems to want something for nothing and is not willing to make a commitment and work for it. At this point, I wonder honestly just what your motives are. You surely do no good for ham radio and what it stands for. As they say in Ann Landers... just sign me as "Disgusted in Hendersonville, TN"

Frank Schwartz, W4KFK

Dear Disgusted, you can find my motives articulated—rather well, I think—on page two of each issue of The Amateur Radio Communicator. I remember hearing the same sort of nonsense when I got my Novice license. By reducing the code speed from 13 to five spm I didn't really have to work to earn a ham ticket and, of course, the Conditional Class hams were all cheaters. I wound up setting off to the side at club meetings because the dinosaurs did not consider me a "real ham."

CB JARGON

Hi Don:

I picked up a copy of your publication at my local HRO outlet today and was interested that you are very much in support of the "No-code" Techs. Since 1990 I have noticed that the area of 28.3 to 28.5 (Novice/Tech enhancement area of 10 meters) sounds more and more like 27 MHz! As we make it easy to obtain an Amateur license, it seems that the crowd coming from CB to ham operation is forgetting a very important fact. Long established hams resent hearing them use CB jargon. Part of the problem is that local ham clubs are not bothering to teach their classes proper on-air procedures, ham vocabulary and common courtesy. I hear many Advanced and Amateur Extra hams that sound like CBers. It would seem to me that we should strive for QUALITY instead of QUANTITY! I was licensed in 1959 as WA2GCH.

Chuck, if new hams exhibit ANY bad habits, they should be corrected in a helpful, courteous manner. Peer pressure and approval is a very powerful corrective mechanism.

WE'RE DOING SOMETHING RIGHT!

Dear Don:

Recently I took my General test using your book *UPGRADE!* and passed very easily. I want to thank you for helping me to pass. The material was presented very clearly without a lot of bull. I went to the local ham store and was upset because there was no Advanced or Extra study guide. They said the only one they had seen was for General. If the Advanced or Extra are available, please advise. If not, get busy! Thank you for your book *UPGRADE!*

73 Robert Stearns, KA0KKF
St. Louis, MO

Thanks for the kinds words, Robert. For the moment, we are going to confine our efforts to the beginners end of the scale. Maybe later, after we have everything a newcomer could ever want, we'll produce Advanced and Extra manuals.

RUSSIAN SATELLITES

Don:

I made two QSOs on RS-12, my first ever satellite QSOs. Kinda like being a Novice again! I can hear myself on RS-10 on 10 meters while transmitting on two meters but no QSOs there, yet. Most of the time I've been on RS-10, it's been in the wee hours of the morning when there aren't many others on the air. This is exciting...I never knew it was this easy to work the "birds," especially with equipment I already have. Thanks for the article about operating on the RS satellites. Anyone following your instructions for operating should have no problem.

73 Dave, KA5J
Tulsa, OK

HE'S JUST KIDDING FOLKS (I THINK)

Dear Don:

Is there any question that Cellular phones cause brain problems? Of course not! Look at the way these people drive while leaning over the mouthpiece and having their tiny brains radiated. You are cruising down the highway—you want to pass, but no—some weenie with a cellular phone has had the logic and reason part of his brain destroyed and is doing 35 MPH in the passing lane! Cellular phones melt brains. How can anyone deny it? Now the question is, should we allow cellular users into the military?

J. Michael Graves

READER RECOGNIZES A GREAT IDEA!

Dear Don:

I read, with interest, your editorial in *The Communicator* (Vol.2, No. 6) concerning entering a proposal for allocating a portion of the 160-meter band for use by codeless Technicians for Morse communication/practice—limited to five watts, CW only. I feel this proposal has great merit and would surely spur the codeless Technicians to enter the area of CW more readily. I feel such a move might increase the number of codeless Techs entering the upgrade to Tech Plus and General Class by as much as 30% of the codeless Tech licenses now in existence. I support your efforts in this quest wholeheartedly and hope the FCC and ITU will do the same. It is the best proposal I've heard lately from the few thousand floating around out there.

Best regards,
Ron Jebard, KB5UUY

AND FINALLY, 73

Dear Don:

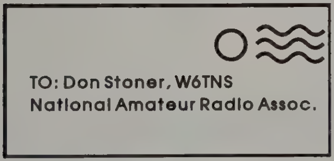
Thank you for sending me a trial issue of The Communicator. I found it well-written and informative, however, I have no further interest in ham radio. To me, other than those who handle emergencies, it's just a bunch of big boys with big toys. What a waste!

Sincerely,
Budd Willis, KD4EYX
Port Orange, FL

MY FIRST MISTAKE THIS YEAR

Usually I can get through the entire year without making one single mistake—but not this year. I made two mistakes in answering Robert West's letter! At the last count 542 people had brought this to my attention! In my reply to Bob, I indicated the VE could waive the code requirement if one has an impairment letter from your doctor. WRONG! No waivers are allowed at the five WPM level for a Tech Plus and Novice license. International law requires that everyone demonstrate proficiency in the code in order to have high-frequency privileges. The examiners are encouraged to make accommodations for a specific handicap but they are not allowed to sign-off waivers from a doctor at the five WPM level—only at 13 or 20 WPM! I compounded the mistake by saying "Examiners...grant you Technician Plus." WRONG! Examiners can't grant privileges. Only the FCC can do this. The VEs simply attest to the fact that you have met the testing requirements. I apologize to all those hard-working VEs for making their job just a little more difficult. 73, Don, W6TNS

Join The Dialog!
Write to us at NARA
P.O. Box 201407 Arlington, TX 76006


TO: Don Stoner, W6TNS
National Amateur Radio Assoc.

Looking Back

(Continued from page 4)

between. Finally one day came the sad news that my dear mentor, the lovely paralyzed lady with the Swan 350, had passed away. Over the years many Amateurs have remained in my memory, but none ever found a place in my heart like WA6VDS.

Her memory was revived again recently, when from halfway around the world, I encountered another dear friend from the old days. His signal towards my present home here on Guam in the West Pacific was weak, but his voice was a joy to hear. It was Larry Garrisi (WB6AZB—Always Zero Beat.) Decades before, I had introduced him to Mary Randall. He was a visually impaired teenager when we first met all those years ago on the Novice band, and he had found something in Amateur Radio akin to what it was for Mary; contact with an otherwise difficult to reach part of his world. He asked about her, and although she died 12 years earlier, he was unaware she had become a "Silent Key."

Larry and I reminisced via 20 meters about good times we shared in the '60s on 40-meter sideband when we first got our General Class licenses during high school. We had been best friends. He introduced me to sightless culture and many wonderful experiences a kid with regular vision might otherwise never know. We drove all over California in my first car. I loved his parents and sister.

We talked at length while the band was open between California and Micronesia. "So you dropped WA6MMX and got a KH2 callsign, huh?" "Yea, I've been out here five years!" "What ever happened to John, WA6ZJC?" "He's a disc-jockey in San Diego.... Remember Charlene, WB6FFE?...She's an Electronics Prof at Cal State Northridge." "Bill, K6-kay-zed-aye, still operates net control sometimes for the West Coast Amateur Radio Service. ...Hey, how come you're on Guam?" "Ah, I'm an airline pilot. ...Did you know I learned how to fly?"

Larry and I spoke in sentimental praise of the patience and courage of Mary Randall, and before signing 73, the subject of just what Amateur Radio has been to us over the years came up. Both of us acknowledged a fascination with radio energy as a concept, the pleasure of homebuilt projects, CW, and DXing. But Larry made a poignant observation when he remarked that unlike many hobbies, Amateur Radio brings people together as its purpose, not as a secondary effect. Those relationships are lasting more often than casual.

Only time, not distance, can separate Amateur Radio operators. Years may pass, but we will remember each other's callsigns, and the impressions we left. Relocating can't untie our friendships. No matter where we are, one day a familiar voice may show up on frequency, and spanning time and distance, bring these good old days back once more.

73 de Mark, KH2FG ❑

POOF—Where Did They Go?

Some of our more sharp-eyed readers will notice a few changes around The National Amateur Radio Association. The major change is the address shown in the magazine. We have opened a new office in the midwest. All sales and marketing will take place from this point. The Arlington office will better serve you and be closer to our printer and mailing office. We ship out of Dallas, which is closer to the center of the U.S. You can write NARA at P.O. Box 201407, Arlington, TX 76007. The phone number for inquiries is (817)860-0970 and the FAX is 860-0979. Our apologies to anyone who was inconvenienced while we switched the phone numbers around. Incidentally, don't be surprised when we open an Editorial Office on the east coast later this year.

I am also pleased to announce that Joe Condron, AA5LD, has joined NARA as General Manager of the Arlington office.

Get The Most Out Of Your Handheld

(Continued from page 15)

Setting The Channel—You don't really need to know this, but you can use the information to amaze your new ham friends and create the impression you are an electronics wizard.

As I mentioned in the foreword, modern handheld radios no longer use quartz crystals to determine the frequency of the operating channel. All of the current radios use a circuit celled a *phase locked loop* or *PLL* for short. The PLL circuit uses one standard crystal frequency. Then, by electronic mathematics, it creates all the frequencies necessary to operate the handheld radio.

Icom's Ifull-featured C-P2AT pocket-sized two-meter handheld.

What you are concerned about, however, is controlling the PLL. How do you change the frequencies in your radio? The simplest form, used on some Icom radios, is a *thumbwheel switch*. You use your thumb to rotate one of several wheels on which are embossed the digits zero through nine. Since the 14 in 144 MHz is always the same, the thumbwheel is ordinarily used to set the remaining three digits such as 400 in 144.00.

Another popular method of frequency change is a *rotary switch*. This type of radio almost always has a frequency display. Rotating the knob changes the mathematics of the PLL and the resultant channel frequency of the equipment is shown on the display. Almost always there is a secondary button or switch that allows the knob to adjust megahertz rather than kilohertz. Thus you can use the knob to select the correct megahertz range, then switch and dial in the frequency in kilohertz. Without this provision, it would take a lot of twisting to go from say 144 to 148 MHz.

The third type of frequency setting device is the *keypad* I mentioned earlier. The keypad can be used by itself or in conjunction with a frequency setting knob. On some radios you enter the entire frequency (say 146.55) by punching all the numbers into the keypad. This is always the case for dual-band radios. On two-meter radios you only enter the last three digits, since the 14 never changes. ❑

W6TNS's new book, "Understanding Your Handheld Radio" will be in stock at all major Amateur Radio Dealers about the time you read this. Look for it if you want more information on your handheld.

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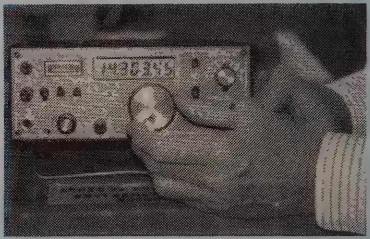
NARA Presents

The Lowest Cost SSB

If you are ready to get active on the HF bands, *have we got a deal for you!* Atlas Radio Co., of Cardiff, California, has just introduced a new single sideband transceiver, their Model 310. With an introductory price of $795, it appears to be the lowest cost SSB on the market. For those of you who don't know about Atlas, it is the newest offspring of Herb Johnson, W6QKI. And for those of you who don't know Herb, he is one of the pioneers of Amateur Radio SSB communications. In 1961 he introduced the low-cost SWAN line of ham gear which helped popularize the SSB mode on our high frequency bands.

The 310 covers all nine Amateur HF bands with a power rating of 150 watts SSB, 120 watts CW, and 80 watts on packet or AMTOR. It can receive and transmit on any frequency between 1.8 and 29.7 MHz, or operate on split frequencies for DX'ing. A seven-digit display uses easy-to-read 0.4" high numbers. The design incorporates DDS which stands for Direct Digital Synthesis (no phase-locked loop) and single conversion with a 9.0 MHz IF. Herb has included crystal filters for optimum selectivity on wide-band SSB (2.7 kHz), narrow-band SSB (1.8 kHz) and CW/DATA (600 Hz). The 310 operates on 12-14 VDC, measures a tiny nine inches wide, 3.5 inches high and nine inches wide and weighs eight pounds (less optional power supply).

Want more information? Drop a line to Herb Johnson, W6QKI, at Atlas Radio Co., 1556 Lower Lake Ct., Cardiff, CA 92007 or call (619) 944-9622.



Herb's hands illustrate the tiny size of the 310 SSB radio.

NARA Is The *Only* National Organization
exclusively devoted to
Novice and Technician Class Amateurs!

Who Is The National Amateur Radio Association?

NARA is striving to publicize Amateur Radio to the general public, attract young people to the Amateur Radio Service, increase the stature and benefits of the Novice and Technician class license and save the various Amateur bands from confiscation by commercial interests.

Recently, Amateur Radio lost part of the 220-MHz band and, in some areas of the country, is in the process of *losing access* to another band (900 MHz).

We must get more people involved in the Amateur Radio Service so we can increase activity and retain our remaining Amateur bands.

NARA brings you an exciting future as an Amateur Radio operator!

Who Should Belong to the National Amateur Radio Association?

- Anyone interested in obtaining an Amateur Radio license
- New Amateur Radio operators of all classes
- Public and private school teachers who want to introduce their students to Amateur Radio
- Beginning Novice and Technician class Amateurs
- Elmers who want to assist beginners
- All Amateurs concerned about the future of the Amateur Radio Service

What Will You Gain when You Join NARA?

1. Knowledge to help you get the most from the Amateur Radio Service
2. You will insure a solid future for the Amateur Radio Service
3. You will be helping others become involved in Amateur Radio
4. Plus you receive our member journal, *The Amateur Radio Communicator!*

Join the National Amateur Radio Association and receive *The Amateur Radio Communicator!*

Here's What You'll Find in the *Communicator!*

- Colorful editorials by Don Stoner, W6TNS
- The electronic adventures of Dan and Burke
- Satellite communications
- Transmitter hunting
- Help passing your Novice or Tech exam
- Erecting your first antenna, propagation
- Types of Amateur Communication
- Pictures and news about other Novices and Technicians...The Future of Our Hobby
- Hot Tips—News you need as an Amateur
- Current information on the VE program
- Repercussions that regulation changes will have on the future of Amateur Radio

When you join NARA, your membership dollars will be used to ***further these goals***. Let's face it—with a membership cost of only $10.00 per year, ***you won't find a better value in Amateur Radio!!!*** Join today! It's easy. Just complete the subscription form below and mail your check or money order. For the fastest service, call 1-800-GOT-2-HAM(1-800-468-2426) with your Visa or MasterCard number.

Yes!

NARA
NATIONAL AMATEUR RADIO ASSOCIATION
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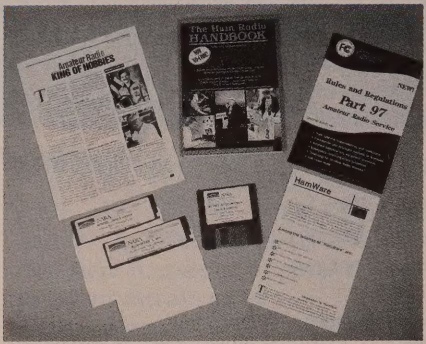
HOW DID I GET THIS MAGAZINE?

ONE OF THE WAYS WE CAN TELL THE WORLD ABOUT the goals and ambitions of the National Amateur Radio Association is to supply complimentary copies. We send about 10,000 pieces to newly licensed hams. This magazine is also mailed to a select list of people who might be interested in becoming Amateurs. We also send approximately 10,000 copies to NARA members and prominent people in Amateur Radio.

If your mailing label does not include a NARA membership number, this may be your last or only copy of *The Amateur Radio Communicator*. We would like to continue providing you with this informative publication, but we can only do so if you are a member of NARA. For those interested in becoming a ham, or who are newly licensed, a membership in NARA represents an outstanding bargain. A membership, which includes a subscription to *The Amateur Radio Communicator*, is only $10.00 per year.

Check the mailing label for your membership number. If you don't see one, look at the NARA advertisement and read the benefits of becoming a member of this fast-growing organization. We need your support and so does ham radio. Help us get it "going and growing!"

AVAILABLE FROM NARA


Amateur Radio KING OF HOBBIES
The Ham Radio HANDBOOK
Rules and Regulations Part 97 Amateur Radio Service
NEW!
HamWare

Pass the New Codeless Technician Test!

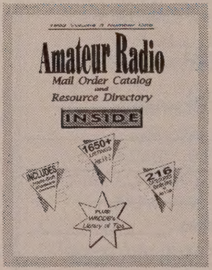
Everything you need to pass the new codeless Technician Class exam! The **NARA Codeless Technician Package** includes:

- *The Ham Radio Handbook,* the 200+page study guide that guarantees you'll pass the test or your money back!
- HamWare software for testing your knowledge
- FCC Amateur Rules and Regulations book
- Bonus Morse code training program (IBM) 0 to 25wpm
- Complete list of Contact Volunteer Examiners
- *King of Hobbies* publication, a special introduction to Amateur radio

The NARA Codeless Technician Package (IBM) is just $29.95 (3.00 S&H) #P110.

Having Trouble with Code?

The **Morse Academy,** IBM software, actually teaches all 43 required code characters and then steps you up through the Amateur Extra level using sophisticated computer aided instruction techniques. Adjustable tone, standard or Farnsworth spacing. Sends text or randomly generated characters—plus an on-disk manual! (5¼" disk) ***WAS* $14.95, *NOW ONLY* $9.95 ($1.50 S&H)** #S410.



NEW 1993! Amateur Radio Mail Order Catalog And Resource Directory

Now bigger than ever! With **30 more pages, 30 new categories,** and over **150 more listings** it has never been a more valuable resource for your ham shack! You'll find everything from A to Z, including parts and equipment, kits and keyers, QSL cards, even personalized hats, mugs, and license plates. There's an extensive listing of radio clubs worldwide, international radio magazines, and over 100 free catalogs available just waiting to be requested!

Use it again and again as you reference products, clubs, catalogs, shareware and much, much more! The ***Amateur Radio Mail Order Catalog and Resource Directory* with 260 pages is only $14.95 ($3.00 S&H)** #B660.

HamWare™ Testing Software

The **HamWare,** IBM compatible (5¼" and 3½" disks) testing software, provides all the practice you need to get your first license or to upgrade. Drawings and diagrams appear automatically on screen along with the appropriate questions, and there's even a practice mode, complete with hints, answers and help screens. There's even a handy on-screen scientific calculator. Your choices are mouse or keyboard selectable. As a bonus, each disk includes a copy of **Morse** software for learning Morse code.

- HamWare Nov/Tech Classes w/Morse #S210
- HamWare General Class w/Morse #S211
- HamWare Advanced Class w/Morse #S212
- HamWare Extra Class w/Morse #S213

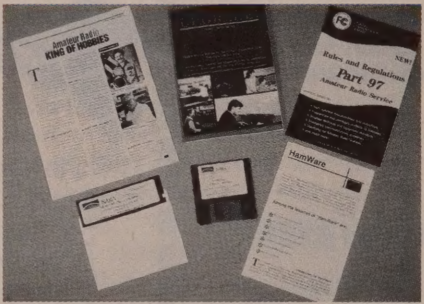
HamWare is available at Amateur Radio dealers or directly from NARA. License classes are sold individually. Each class is only **$14.95 ($2.00 S&H).**

NARA Amateur Training Package

Start with your Novice or no-code Technician license and go "all the way" to Extra class with this excellent IBM compatible training package that includes:

- HamWare Novice/Technician Classes w/Morse
- HamWare General Class w/Morse
- HamWare Advanced Class w/Morse
- HamWare Extra Class w/Morse
- 60-page *FCC Rules and Regulations, Part 97*
- *Amateur Radio—King of Hobbies*
- An extensive list of Contact Volunteer Examiners.

Save by ordering the **NARA Amateur Training Package.** This entire package (5¼" and 3½" disks) is only **$32.95 ($3.00 S&H)** #S220.


Amateur Radio KING OF HOBBIES
Rules and Regulations Part 97 Amateur Radio Service
NEW!
HamWare

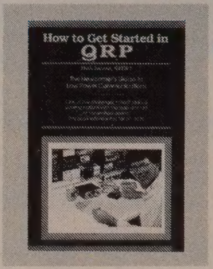
Upgrade to General Class with the NARA UPGRADE Package

NARA has put together all the essential tools you'll need to upgrade to General class. This value-packed offer includes:

- *UPGRADE! to General Class* by W6TNS
- HamWare General Class IBM (5¼" and 3½" disk) testing software w/Morse
- 60-page *FCC Rules and Regulations, Part 97*
- *Amateur Radio—King of Hobbies*
- An extensive list of Contact Volunteer Examiners

The **NARA Upgrade Package** is available at Amateur Radio equipment dealers or directly from NARA for only **$29.95 ($3.00 S&H)** #P240.

A **FREE** issue of ***The Amateur Radio Communicator*** will be mailed to you at a later date when you order any NARA product!



NEW! Introduction to QRP!

NARA does it again with its ***How To Get Started in QRP*** book. QRP (meaning low-power operation using five watts or less) offers a unique and exciting challenge for today's ham. Written by Dave Ingram, K4TWJ, "*QRP*" covers an overview of QRP, accessories, operating tips, power sources, homebrew, clubs, awards and more. With today's technology and equipment, working the world with QRP could be the ultimate challenge! ***How To Get Started in QRP*** is available at all major ham radio stores or directly from NARA for only **$9.95 ($2.00 S&H)** #B690.

MacHam™ Testing Software

MacHam is one of the most useful series of ham radio programs written for the "Mac." All required circuit diagrams are displayed with the question on the screen. If the test is printed, the diagrams are included.

The tests can be taken on screen, by element or by chapter, with options of immediate or end-test scoring. Printouts create exact VE style exams, with question pool numbers, correct and blank answer sheets.

- MacHam Nov/Tech #S310 **$39.95 ($2.00 S&H)**
- MacHam General #S311 **$29.95 ($2.00 S&H)**
- MacHam Advanced #S312 **$29.95 ($2.00 S&H)**
- MacHam Extra #S313 **$29.95 ($2.00 S&H)**

Pass the Codeless Technician Test with the MacHam™ Education Package

The **MacHam Education Package** includes:

- MacHam Novice/Technician Class Software
- *Ham Radio Handbook,* by Donald Stoner, W6TNS
- Ham radio *FCC Rules and Regulations, Part 97*
- *Amateur Radio—King of Hobbies*
- An extensive list of Contact Volunteer Examiners

Order direct from NARA today. **The MacHam Education Package** is only **$49.95 ($3.00 S&H)** #P320.

Upgrade to General with the MacHam™ Upgrade Package

If you want to upgrade to General Class, you need the **MacHam Upgrade Package** which includes:

- MacHam General Class software
- *UPGRADE!* book by Donald L. Stoner, W6TNS
- Ham radio *FCC Rules and Regulations, Part 97*
- *Amateur Radio—King of Hobbies*
- An extensive list of Contact Volunteer Examiners

The **MacHam Upgrade Package** is only **$44.95 ($3.00 S&H)** #P340.

Learn the Code with these Outstanding Cassette Tapes!

These cassette tapes will give you the practice you need to pass your code exams. Each set contains two cassette tapes. Each set sold separately.

- Novice/Technician Class 0 to 5wpm #T710.
- General Class 5 to 14wpm #T720.
- Extra Class 12 to 24wpm #T730.

Order today for only **$11.95 ($2.00 S&H).**

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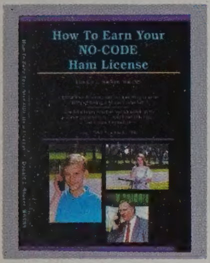


How To Earn Your No-Code Ham License

By Don Stoner, W6TNS, is the leading book for anyone wishing to earn the new code-free Tech license. Includes every question plus the multiple-choice answers.

How To Earn Your No-Code Ham License is the only test manual that includes simple and easy-to-understand theory along with many photos and illustrations. There are ten chapters covering each subelement. Sample tests are given at the end of every chapter with a list of correct answers at the back of the book. Guaranteed to provide all the information needed to get your ham radio license or your money will be refunded. ***How To Earn Your No-Code Ham License*** is only **$9.95 ($2.00 S&H)** #B610.

FCC Rules and Regulations

The FCC, Rules and Regulations Part 97, covers the guidelines and rules of the Amateur Radio service. This 60+ page book is an excellent reference for every class of license; a resource book no ham shack should be without! ***Rules and Regulations, Part 97, Amateur Radio Service*** is only **$4.95 ($1.00 S&H)** #B640.

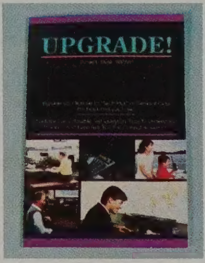
All About Ham Radio

This is the book that Don Stoner wishes he had written. Harry Helms, AA6FW, wrote this book in a manner that can be understood by everyone from young to old alike. Although not keyed directly to the question pools, it provides all the information you need to know to become a Technician Class Amateur.

Over 290 pages of jam-packed information including Hams And Their Radios, Customs, Habits And Other Good Stuff, Single Sideband, Ham Radio Meets the Personal Computer, Folklore, and much more.

For a book that covers so many different aspects of the Amateur radio hobby ***All About Ham Radio* is a steal at only** **$19.95 (3.00 S&H)** #B680.

Order Today!



UPGRADE! To The Tech-Plus and General Classes!

UPGRADE to General Class by W6TNS shows "no-code" hams how easy it is to upgrade to the Tech-Plus or General Class license!

UPGRADE! has nine chapters covering each subelement of the General Class exam. All multiple-choice questions and answers for the General Class exam are included. Tips and special hints for learning the code and increasing your speed are also included!

UPGRADE! is available from Amateur Radio stores, or direct from NARA for **$9.95 ($2.00 S&H)** #B620.

Play It Up! With NARA's New Videotapes

Explore Amateur Radio through exciting videotapes! Directed by some of the best-known names in ham radio, these videotapes are the perfect addition to every ham's collection. Choose from the following:

Getting Started In Ham Radio. Covers the early stages of ham radio including station layouts, safety, choosing and setting up equipment and repeaters. By *CQ Videos*, **only $19.95 ($3.00 S&H).**

Getting Started On Amateur Satellites. A "how-to" guide for the newcomer wanting to work the world through Amateur satellites. Discusses equipment, DXing and more. By *CQ Videos*, **$19.95 ($3.00 S&H).**

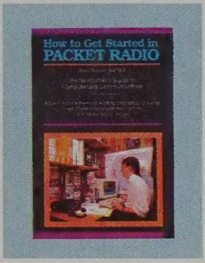
Getting Started in Packet Radio. A "how-to" guide to setting up a computer-to-computer station, getting on the air, QSOs, and operating packet effectively. By *CQ Videos*, **only $19.95 ($3.00 S&H).**

Getting Started in DXing. Successful DXers offer their tips on getting started, proper operating skills, snaring the rare ones, basic equipment and more. By *CQ Videos*, **only $19.95 ($3.00 S&H).**

Reading, 'Riting and Radio! Great for teachers and instructors, educator Carole Perry, WB2MGP, with her students and ham radio classes for children shows how beneficial and exciting ham radio is in school for teaching geography, world affairs, current events, math and more. **Only $19.95 ($3.00 S&H).**

CQ Field Day! Designed to help hams who want to set up their equipment in the great outdoors, this tape takes you to the award-winning 22A Field Day station. It shows you everything from setting up to packing up an outdoor radio station. **Only $19.95 ($3.00 S&H).**

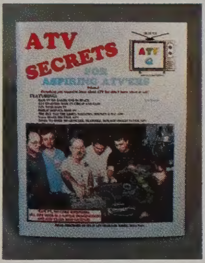
Ham Class. Well-known instructor, Gordon West, WB6NOA, helps prepare students and instructors to set up a ham class. The tape contains live classroom demonstrations and tips on setting up classes or training seminars. **Only $19.95 ($3.00 S&H).**



NEW!

Packet Radio For Beginners

NARA has done it again with ***How To Get Started In Packet Radio*** written by well-known author Dave Ingram, K4TWJ. This informative new book explains the practical side of packet radio in a simple-to-understand manner. It begins with a non-technical description of packet radio, followed by chapters including *Getting Started, Setting Up Your Station, Operating Packet to Networking* and *HF Operation.* There is even a *Packet Radio Equipment Survey* and an appendix that includes circuits for interfacing equipment! Get ***How To Get Started in Packet Radio*** **today for only $9.95 ($2.00 S&H).** #B670



ATV Secrets For Aspiring ATVers

ATV Secrets For Aspiring ATVers, written by Henry Ruh, KB9FO, contains everything you wanted to know about **Amateur Television (ATV).** All ham licensees can participate in ATV—*even those with the new no-code license!* Amateur TV is fun and exciting. Take your own home video productions, make new friends and get more enjoyment from your video equipment. Hams should be *seen* as well as heard!

ATV Secrets is available through all major Amateur Radio equipment stores, or direct from NARA for only **$7.98 WAS $9.98 ($2.00 S&H)** #B630.

The FCC Question Pools—

Each booklet contains all the questions and answers for each license class. Does not contain explanations. Order your booklet by license class.

- Novice and Technician classes together (all the questions for the new code-free Technician class license) **$4.95 (S&H $1.00)** #B650.
- General Class **$3.00 (S&H $1.00)** #B651
- Advanced Class **$3.00 (S&H $1.00)** #B652
- Extra Class **$3.00 (S&H $1.00)** #B653.

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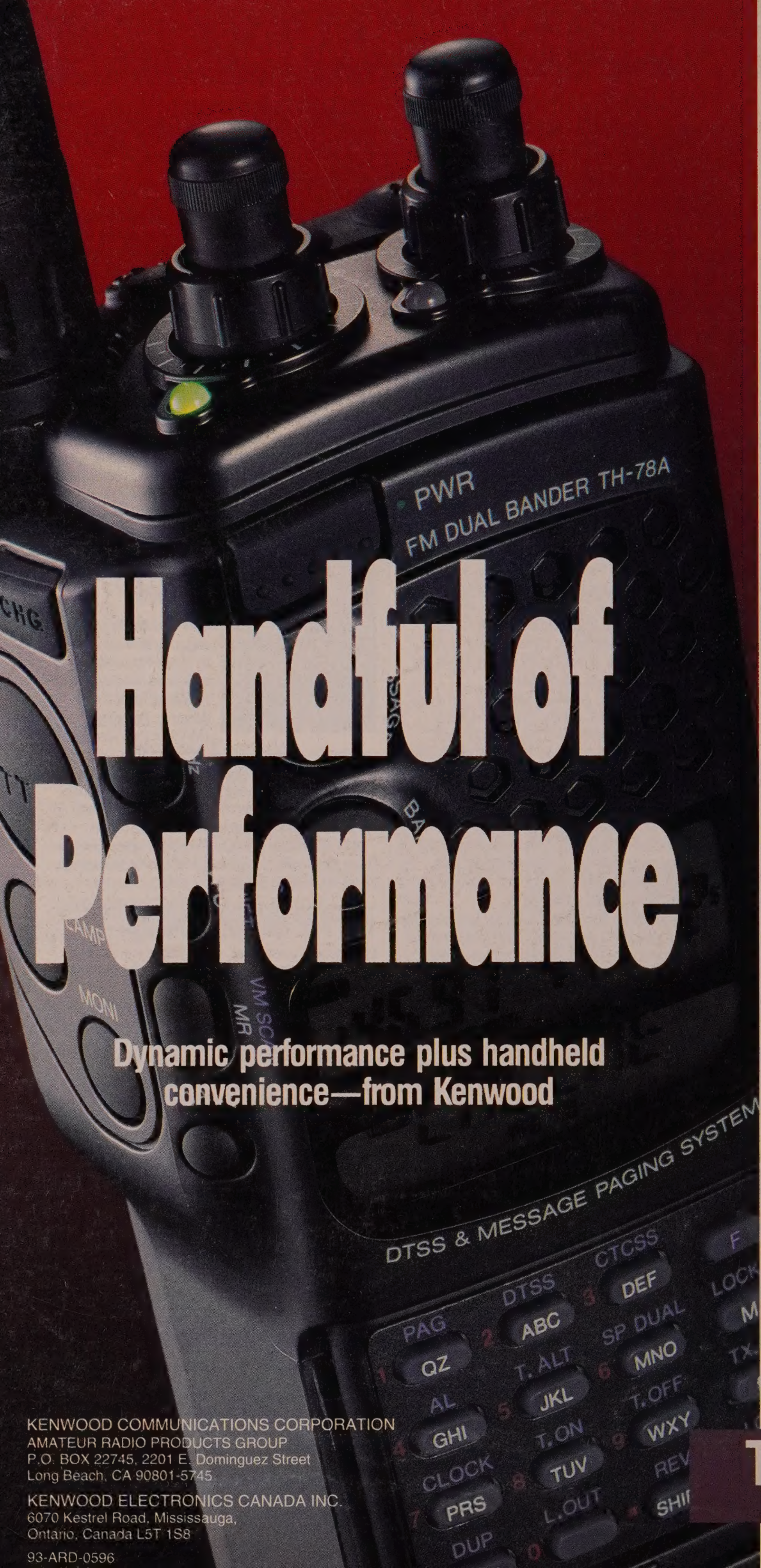

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Dynamic performance plus handheld convenience—from Kenwood

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6070 Kestrel Road, Mississauga,
Ontario, Canada L5T 1S8

93-ARD-0596

KENWOOD

...pacesetter in Amateur Radio

To get the most out of handheld communications, choose Kenwood's TH-78A (144MHz/440MHz) which offers all the latest features. Or the TH-28A (144MHz) and TH-48A (440MHz) single-band transceivers, which are equally impressive. All three represent a winning combination of top-flight technology and ergonomic design.

- **Alphanumeric memory**
  Alphanumeric data (max. 6 characters) can be entered directly into memory.
- **Alphanumeric message paging**
  In addition to standard DTSS and paging functions, alphanumeric messages can be stored in memory for immediate transmission.
- **Dual-frequency receive**
  In addition to full-duplex cross-band operation, the TH-78A is equipped to receive two frequencies simultaneously, even on the same band. There's also independent double-band scan and ABC (automatic band change). The TH-28A and TH-48A feature dual-band receive capability, enabling semi-duplex cross-band operations (TH-28↔TH-48A).
- **Frequency coverage**
  TH-28A: 118-173.995 MHz, sub RX: 438-449.995 MHz; TH-48A: 438-449.995 MHz, sub RX: 136-173.995 MHz; TH-78A: 118-173.995, 438-449.995 MHz. Transmit on Amateur bands only. (MARS/CAP modifiable, permits required).
- **2.5W power with supplied battery pack**
  5W with 12 VDC power source (PB-14, PB-17, or external DC).
- **Non-volatile memory**
  The TH-78A has 50 memory channels (expandable to 250 with the ME-1 option), while the TH-28A and TH-48A have 40 channels (expandable to 240 with the ME-1 option).

TH-78A/28A/48A

FM Handheld Transceivers